

Great Lakes Binational Toxics Strategy Mercury Workgroup

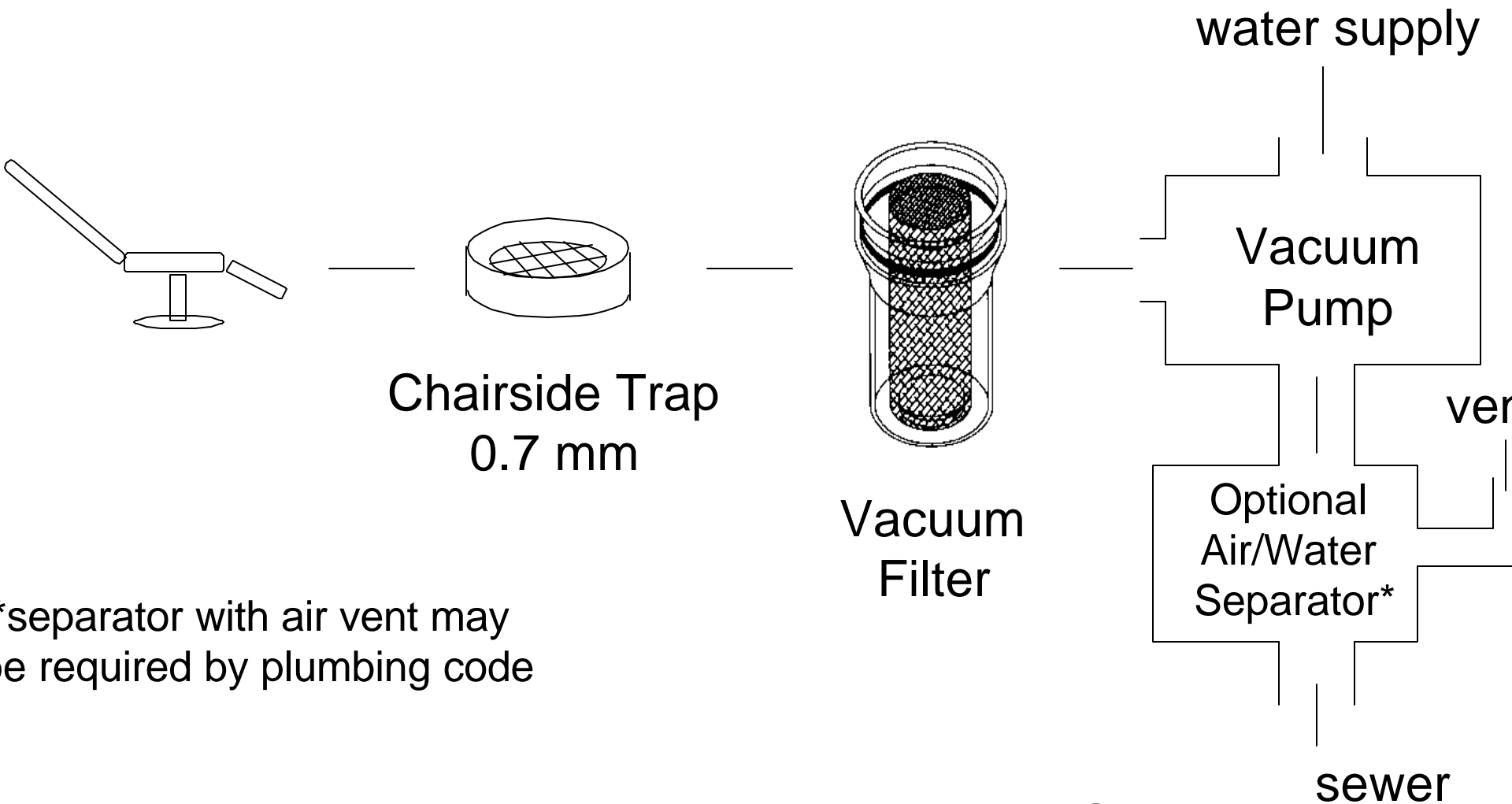
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**Defining the Issue: Assessing the Fate and
Impact of Dental Amalgam**

**Loadings of Dental Amalgam/Mercury
To Wastewater Treatment Plants**

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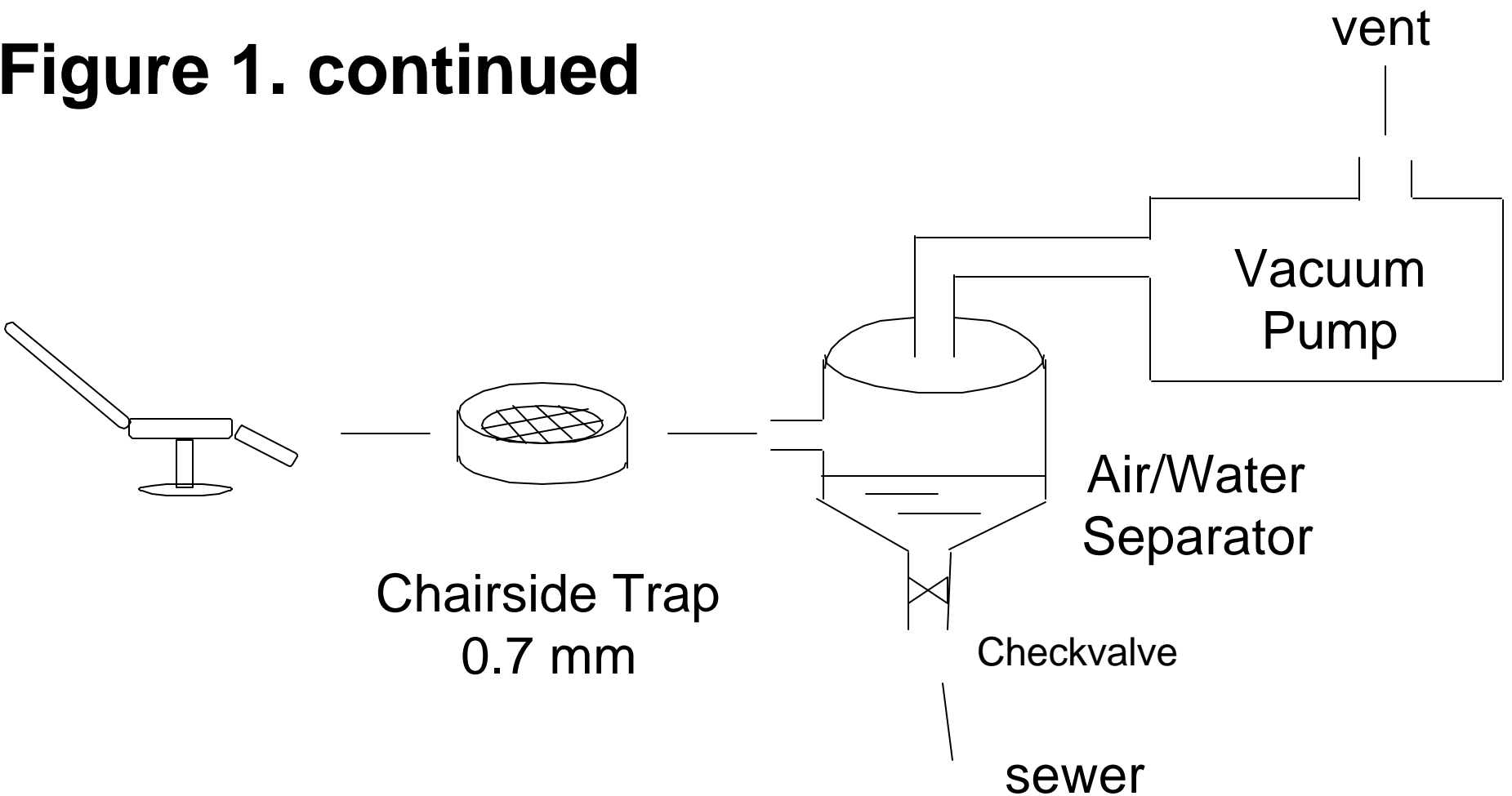
Figure 1. Dental Clinic Vacuum Systems



*separator with air vent may
be required by plumbing code

Liquid-Ring Vacuum Pump System

Figure 1. continued



Turbine (Dry) Vacuum Pump System

(liquid-ring or turbine vacuum pumps may serve multiple chairs)

(Table 1) Mercury Sources as a Percentage of Minneapolis - St. Paul Area WWTP Loadings

	Current Estimates
Industrial Permittees	7 % - 14 %
Residential	11 % - 16 %
Dental Clinics	76 % - 80 %
total	94 % - 110 %

Dental loading based on 250-261 mg Hg/dentist/day (WEF 1999)

Studies Completed Under a Partnership
Between Metropolitan Council Environmental
Services and the
Minnesota Dental Association (2001)

- (1) Community-Wide Dental Mercury Study
- (2) Evaluation of Amalgam Removal
Equipment (Separators) and Dental Clinic
Loadings to the Sanitary Sewer

Overall Findings of Two MCES and MDA Studies:

- Mercury reductions of 29% - 44% achieved at two WWTPs while amalgam separators were in place within clinics (Anderson, 2001)
- Mercury discharged per dentist: 234 mg/operating day (based on sampling at clinic vacuum systems) (Berglund & Diercks, 2001)
- Separator efficiencies of 91% - 99% (based on waste downstream of chairside traps) (Berglund & Diercks, 2001)

Community-Wide Study - Details of Study:

Purpose: Evaluate dental mercury loading by monitoring WWTP sludge with and without amalgam separators in place at dental clinics

Two Minnesota cities: Hastings & Cottage Grove

24 Dentists participated (out of 25)

13 Dental Clinics participated (out of 14)

Separators in place for 3 months in each city

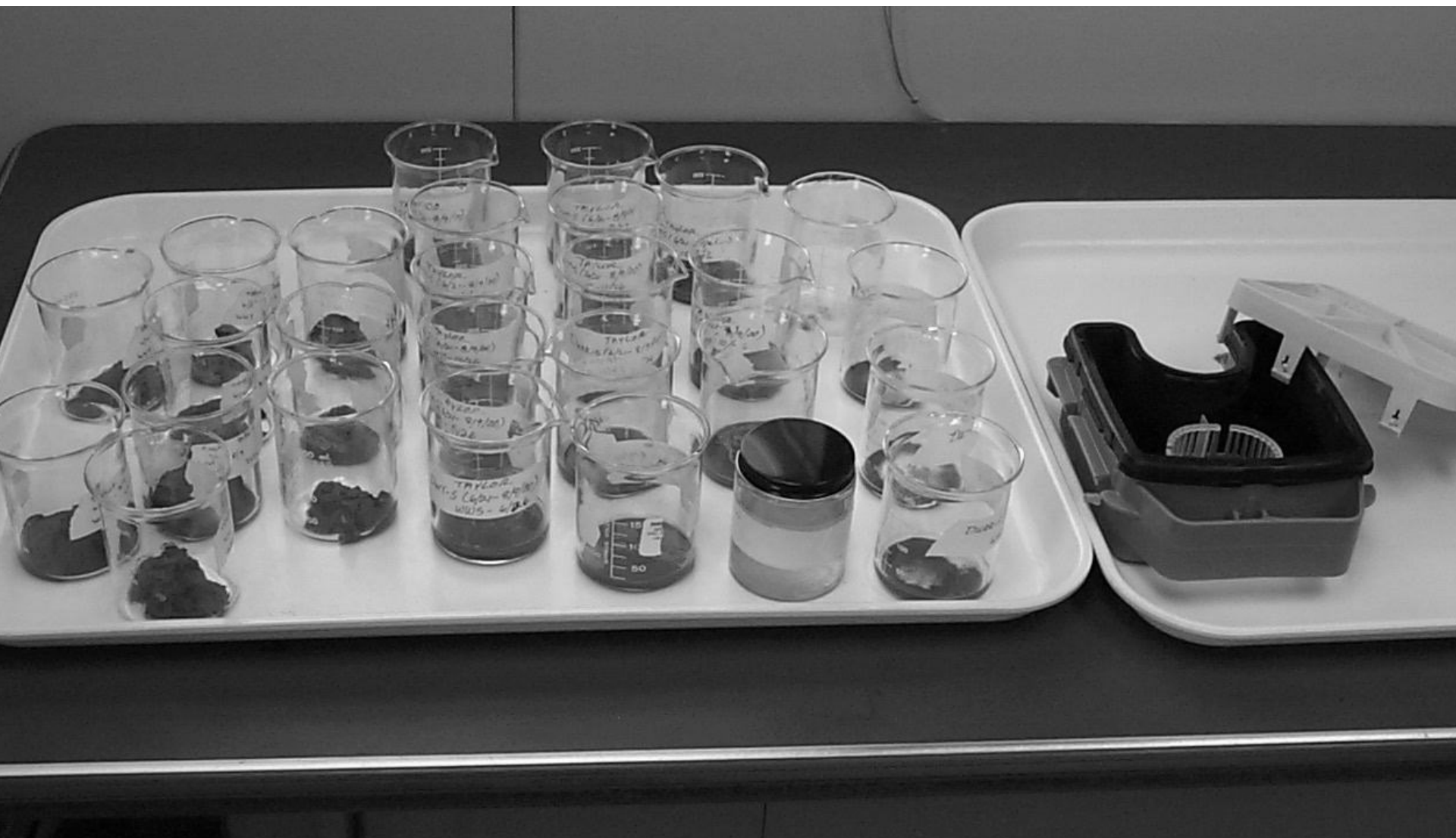
Evaluation of Amalgam Removal Separators and Loadings Study - Details of Study:

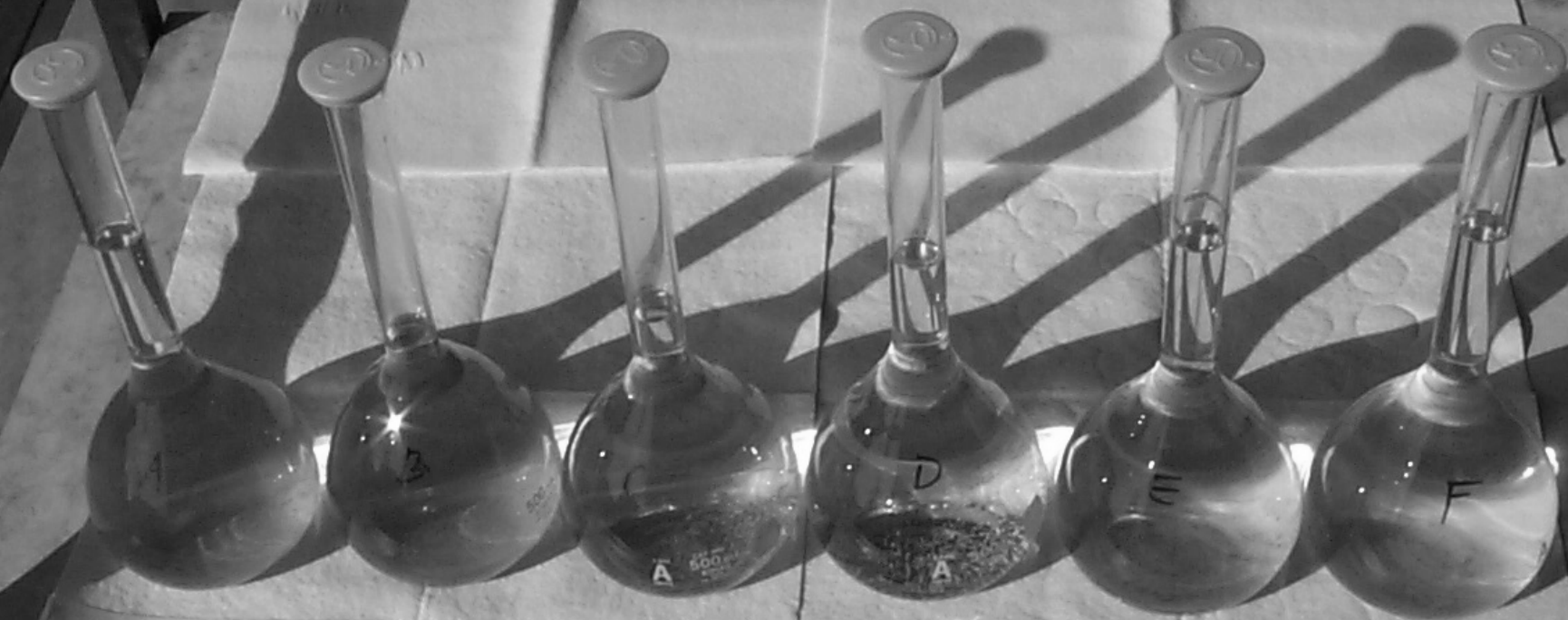
- 7 General Practice dental clinics participated
- 5 Separator models evaluated - No “down-time”
- 87 Cumulative weeks of testing/evaluating
- 275 Operating days of wastewater monitoring (to determine: 234 mg Hg/Op. Day per Dentist)
- All wastewater collected, digested, & analyzed











1235

1003

2072

566

1196

793 mg

Table 2) Discharge Rates From A Variety Of Studies
 (rates given in mg Hg/day C.T. = chairside trap)

	After C.T. (per chair)	After C.T. (per chair)	Discharged (per dentist)	Discharged (per dentist)
Mean	612	708	250	234
Median	499	498		
N	58	99	10	275 (see report)
Source	Cailas, et al, (1994)	Cailas, Drummond, Wu, Ovsey (2002)	Arenholt- Bindslev & Larsen (1996)	Berglund & Diercks (2001)

Clinic Loading Data Based on ADA's October 2002
DRAFT Report by ENVIRON International Corporation

6.34 tons mercury released annually by clinics in U. S.
(after chairside traps and vacuum filter - where applicable)

$$\begin{aligned} 6.34 \text{ tons/year} &= 12,680 \text{ pounds/year} = 5751 \text{ Kg/year} \\ &= 5,751,000,000 \text{ mg/year} \end{aligned}$$

$$5,751,000,000 \text{ mg/year}$$

$$(133,092-122,312 \text{ G.P. dentists})(48 \text{ weeks/yr})(4 \text{ days/wk})$$

$$= 225 - 245 \text{ mg Hg / G.P. dentist / operating day}$$

Percent Removal	"Empty"	"Full"	Average
g10	99.99	not tested	99.99
RU	99.96	99.95	99.96
mal. Collector	99.89	99.96	99.93
asch 890-4000	99.93	99.90	99.92
ME 2000	99.67	99.66	99.67
g5	99.36	99.28	99.32
SS 2000	99.66	98.94	99.30
sdex	99.10	99.36	99.23
ullfroHg	98.88	99.38	99.13
urr 7800/7801	98.06	97.66	97.86
CO II	98.17	97.51	97.84
1000	96.09	96.34	96.22

(Table 3)

**ADA's
ISO
Testing**

**JADA
May 200**

**Avg.
Calculated
by MCES**

References

- Anderson, C.T., Community-Wide Dental Mercury Study. *MCES and Minn. Dental Assoc. Report*, (MCES Report No. 01-507)
- Arnholt-Bindslev, D. and Larsen, A.H. (1996) Mercury Levels And Discharge In Waste Water From Dental Clinics. *Water, Air, and Soil Pollution*, 86: 93-99
- Berglund, P.B. and Diercks, R.W. (2001), Evaluation of Amalgam Removal Equipment and Dental Clinic Loadings to the Sanitary Sewer. *MCES and Minn. Dental Assoc. Report*, (MCES Report No. 01-509)
- Cailas, M.D., et al., (1994) Physico-Chemical Properties of Dental Wastewater. *Proceedings of the Water Environment Federation 67th Annual Conference & Exposition*, Chicago

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ailas, Drummond, Wu, & Ovsey, (2002) Characteristics and treatment of the Dental Waste Water Stream. *Illinois Waste Management and Research Center Reports* (No. 2002/50)

WEF (1999) *Controlling Dental Facility Discharges in Wastewater*. Water Environment Federation, Alexandria VA